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ENGINEERING-EDUCATION

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Bulletin of the

Society for the Promotion of Engineering Education

VOL. XIII LANCASTER, PA., SEPTEMBER, 1922 NO. 1

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Thirty-first Annual Meeting of the Society for the Promotion of Engineering Education

Cornell University

June 1923

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ENGINEERING EDUCATION

Bulletin of the

Society for the Promotion of Engineering Education

Published under the supervision of the Publication Committee:
Chas. F. Scott, Mortimer E. Cooley, F. L. Bishop, *Editor*.

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THE FUTURE OF ENGINEERING EDUCATION.*

CHAS. F. SCOTT,

President, Society for the Promotion of Engineering Education.

My connection with the Society during the past year has naturally led to an intensive study of engineering education. This study has crystallized and confirmed the opinion that our engineering schools are not now producing what the industries and the engineering profession want. On the other hand, the industries and professional societies do not know or at least are not agreed upon what they do want. The increasing importance in our modern life of professional engineers and of men with engineering training for leadership in industrial and other fields brings larger opportunities to the engineering schools and imposes upon them increased responsibilities. The Society for the Promotion of Engineering Education is the logical leader of the engineering schools toward the realization of these opportunities and the fulfillment of these obligations. Will the Society accept this challenge?

After my election as President a year ago I wrote to some of our members asking what the Society should do, and I conferred on the subject with the Secretary. I received one particularly good suggestion, namely, not to try to do everything but to pick out one thing. I looked for that one thing. At the New Haven meeting there had been a disappointing discussion of a very important problem, "How shall we recruit and develop our teaching force?" It was recognized that the fundamental factor in engineering education is the teacher and one of the prime duties of the Society is the development of teachers.

In engineering education we have emphasized the "engi-

* President's address, Annual Convention, University of Illinois, June 21, 1922.

neering'' and neglected the ''education,'' we have emphasized the technical knowledge and the practical experience of the young instructor and have neglected his ability to teach—not merely to impart knowledge but to train and develop the student. The ''one thing'' I chose for Society activity was *better teaching;* each institution was asked to form a Branch which would by papers and discussions aim to promote better teaching. Members in a score or more of institutions have responded. As is usual when a new field is entered or when old problems are attacked in a new way, unexpected results have followed. A significant feature of the Branches is the interest which has followed initial meetings, often in matters where it was not anticipated. New methods have been proposed and new subjects suggested for enlarging and enriching the activities of these meetings. The real object, as one member reports, is to ''get instructors to think on methods of teaching.'' This is not simple and limited, but expands to embrace the full relationship between teacher and student.

I was much impressed last summer by the amount and the variety of work handled by the Secretary's office. Supplementing the routine connected with membership and committees and publications and the like, there are relations with other societies and organizations, there is the employment bureau and the service rendered to individuals and institutions asking information. It is the clearing house between schools and departments and teachers, and would be capable of doing a great deal more if there were greater facilities. Aside from these things the many problems coming up in various phases of engineering education seemed to call for larger leadership. A capable man with full time (our present Secretary is a busy Dean) to give direction to our activities and plan for the future with its larger problems of engineering education, would give the Society a new range of activity, and would give it power to render great service in the engineering and engineering-educational fields.

This problem of engineering education is not fixed and definite; conditions change and engineering reacts on life; it has been one of the great factors in producing the many changes which have taken place in the last generation or two. With these we are all familiar and we know that the underlying factors which have made our modern civilization are science and engineering.

George S. Morison in his presidential address before the American Society of Civil Engineers and later in "The New Epoch" (printed about twenty years ago) pointed out the series of epochs in the history of mankind following new discoveries or acquisitions, such as the use of fire and the domestication of animals. He says that in the centuries of recorded history there is only one event great enough to create a new epoch. That occurred a little over a century ago when the manufacture of power (initially the steam engine) became a factor in human life. It has produced modern industry and transportation and through them has changed the whole life of the world. Instead of being independent individuals, we are interdependent groups; instead of isolated nations there is a world unity.

Mr. Hoover in his first address as President of The Federated American Engineering Societies spoke of the great change in modern life brought about by industrial expansion; our standard of living today is far beyond the conception of our grandfathers. But this new industrial life has its adverse elements; these, if uncorrected, may destroy the good. There is the monotony of the factory; there is seasonal and periodic idleness; there is economic inequality; there is waste; we are dividing into groups and each group looks out for itself; common interest is forgotten. Mr. Hoover said that the one group which was unselfish of purpose and by training should be most useful in adjusting the difficulties between the other groups is the engineering group. The complex activities in the new order of life which have been

brought about by engineering can best be adjusted by the engineer himself.

The new situation was brought out clearly from another angle at a meeting of the joint conference committee of this Society and of the National Industrial Conference Board. There were present half a dozen or more men prominent in industry. The representatives of our Society were greatly impressed by the attitude of these industrial leaders. It was somewhat as follows:

Industry needs men for leadership. It needs men of imagination and vision, with the ability to conceive and the practical sense to carry out new projects. It looks to the technical graduates of colleges for such men. Many industries do not yet realize this need, and many do not know how to make use of them. Graduates themselves lack breadth and vision and initiation. Their training and their ideals are apt to be too restricted and too technical. Both technical men and men for leadership are neeeded; the former are plenty, the latter are few. Much of the specialized training for particular service is a mistake; it is the broader fundamental training that is wanted, a training that fits men for their highest usefulness at the age of 40 or 50, rather than for immediate productivity at 21 or 22. Schools are often lacking in adequate teachers and they expend too much effort on mediocre material.

Not only in industry but in transportation and other public utilities and in many departments of government service where engineering is involved there is need for the man of engineering training for direction and leadership as well as for technical service. All this was beyond the earlier conception of the scope of engineering.

The developments of our modern life bring the engineer face to face with problems of a new order. The first generation of engineers from our modern schools was trained for certain specific technical things. The mechanical engineer must design engines and make them operate. The electrical

engineer must make motors that would run. But the earlier problems are being solved. The production and distribution of power, for example, is being accomplished quite satisfactorily by approved methods. Engineers can and will improve them. But the greater problem now is efficient production; it is how to apply and use this power. The problem in industry is no longer to get a machine to do the work, but to secure a factory system for economical production. Then comes the human problem of proper physical, economic, and psychological adjustment between workers and their surroundings. The engineer who devises machines must follow them into the work place and provide an operating organization, and deal with the new human relationships which the new conditions involve. We talk about the waste of fuel and forests, but the waste of human labor is greater than any of these. An eminent mechanical professor estimates that if we all worked together in an efficient way the present expenditure of human effort could produce ten times as much as is now produced.

In engineering education we do not know or least we do not agree, upon what our objectives really are. We are to produce engineers of a new kind and we do not know just what is demanded. The conditions are changing. The duties of the engineer and the part he is to serve are varied—they range from the construction of a meter or a tool or a bridge to the initiation of enterprises of national scope. The service that Hoover is rendering shows us by precept and example what the engineering type of service in its large sense can do for industry and for the nation. To utilize the elements of nature "for the benefit of mankind" involves more than controlling inanimate materials and physical forces, it must include the human factor. And there is the final test, the end is the benefit of mankind. What constitutes real benefit? The engineer must make it a part of his business to see that the new forces which he provides are really used for the benefit and not the destruction of mankind.

All this has a vital bearing upon the changing situation in regard to engineering education. Looking at it in one way, as Dean Cooley remarked this afternoon, what the engineering schools set out to accomplish they have accomplished quite successfully. Indeed it is because engineering graduates have done their part so well that they are called upon to do more. But it is when we look to the future and consider the larger scope of engineering in modern life and the demands which it makes upon the schools that new problems appear.

Consider for a moment some of the factors that enter into the general problem. Engineering Education should properly include the preparatory and high school and also the first few years after graduation, as these periods in addition to the years in the engineering school enter vitally into the training of the engineer. But the three periods are not coördinated in content nor do they agree in aims and ideals.

There is lack of intelligent understanding among teachers of preparatory schools and among parents as to what engineering really is and what engineering training fits a man to do. If it were intelligently appreciated what opportunities lie before the technical and professional engineer as well as the man of engineering training who is qualified for leadership in the future growth and development of this country, there would come to our engineering schools an influx of boys who are looking forward to lives of large opportunity and active service.

On the other hand we have various relations with engineering societies. During the past year we have had two joint meetings with the American Society of Mechanical Engineers and our convention this week is discussing a group of papers to be presented before the American Institute of Electrical Engineers next week and our discussion will form a part of their proceedings. There were also joint meetings with the American Association for the Advancement of Science. The Federated American Engineering Societies is developing a new understanding of the place of the engineer in the country

under the leadership first of Hoover and now of Cooley. Various industries take an active interest in education and a definite relation between industry and our Society has been established through our conference committee with the National Industrial Conference Board. We have cordial relations with the U. S. Bureau of Education and other organizations.

But these various relationships would have had greater constructive value had they been better directed and coördinated.

Some industries recognize the need of specific training for graduates and provide excellent courses of a year or more. Others do not appreciate the conditions, they do not understand what to expect of graduates and are not doing their part in the training of men.

Our schools have as a matter of course their common problems of curriculums and equipment and staff. They are attacking new things in various ways. There are psychological tests and coöperative courses and project methods of teaching. Some are collecting illuminating data regarding their graduates, studying particularly the relations between the career of the individual student in college and afterwards, to the end that we may better prepare the students who come to us for work that lies before them.

All these matters are part of the general problem of engineering education. Much is being done but there is little coördination. More should be done but we are lacking in the knowledge of many of the facts upon which action should be based. What we do realize is that things are not as they should be; that there is a large problem before the engineering teacher of the present; it is not formulated; it is not solved. To the engineer a problem is an opportunity. It is for us as engineers to accept the opportunity and attack the problem.

I have taken occasion to talk with several gentlemen in position to advise and they have said they believe funds could be found for carrying out definite and adequate plans which might be proposed by the Society. But underlying it all is the question whether the engineering educators themselves will

back up and support the new movement. Little can be accomplished by a man or a committee. What is needed is the interest and activity and enthusiasm of all and then an organization and a leadership by which it can be directed and made effective.

These matters have been under discussion by the Council during the last two days and the outcome has been a resolution directing a development committee to formulate an answer to the question, "What can the Society do in a comprehensive way to develop, broaden and enrich Engineering Education?"

Again let me say that the outcome will depend primarily upon you, the members of this Society.

Will you as an engineering educator and as an engineering society do your part in meeting this challenge for larger service?

CIVILIZATION AND THE ENGINEER.

BY M. E. COOLEY,*
Dean, Colleges of Engineering and Architecture, University of Michigan.

There are differences of opinion and it presumably will take a great deal of time to agree on minor features. The first resolution adopted by the faculty of the University of Michigan two years ago was that there should be ten or twelve hours of technical training taken out of the four-year course and more liberal studies substituted without attempting to designate what they should be. Since then a committee has been at work constantly trying to get together. They have agreed that the first two years can be alike, and have nearly agreed on the subject matter. They have also agreed that the five-year course should embrace about 170 hours (one hundred forty being required for the four-year course); that the five-year course should be about half technical work (by technical work I mean engineering), the other half cultural and subjects the student might wish to take as minors. A number think that English and Modern Languages should stretch through four years and mathematics through three years; and that during the first two years astronomy and surveying (about three hours of each) and shop work should be taken by all engineers; that six or seven hours of chemistry should be required and six or seven hours of engineering mechanics. While considerable progress has been made the result is not at all final. It is a long process.

While on my feet, I would like to say something more. I listened to the paper which dealt with more liberal training, and the discussion which followed it. It was a splendid paper and a splendid discussion; but I fear we all missed the point, that is, forgot the student. In discussing our problems of

* Address at evening meeting of Society, June 22, 1922.

education (and this is not confined to engineering), we are accustomed to consider the student a willing chap and that we can do anything with him we like. There is scarcely a student coming into engineering who has not made up his mind what his life work is going to be. And it is a fight from the day he comes to make him see what is best for him and the profession. A different attitude is very much needed. We ought to be able, with our experience and opportunities for looking about the world, to show these young men that the course they so often propose following is not the one to put them at the top of the profession. Each seeks to make himself highly skilled along some particular line, so that he can penetrate far in some particular direction; and often is absolutely opposed to going in any other direction. Employers of our graduates complain that while they know exceedingly well the thing they have been taught they do not know anything else. Our idea at Michigan in framing longer courses (and also the idea of the fourteen or eighteen deans who have been meeting) is to include a liberal number of humanistic subjects,—as many as possible and still leave the graduate able to practice engineering.

The question has been asked, is engineering one of the learned professions, like law and medicine? There can be no question of course that the engineer has as much learning as the doctor, the lawyer or the preacher. But notwithstanding I think that outside the engineering profession nine out of ten would say no. Why? The lawyer, the doctor and the preacher render their services directly to the individual served; that is, by personal contact. The engineer comes in contact only indirectly; that is, through the things he creates; such for instance as electric lights, telephones, railroads, and the utilities generally. The public uses these things constantly without ever thinking of the man who created them. Mr. Hoover is the exception, of course. Where is there another engineer so well known to the general public? Wonderful as the profession is, why are engineers unknown outside of

the profession? Perhaps the answer lies in the fact that he is an idealist, an individualist, one who finds his happiness in the problems he is solving—in the things he is creating. He has little to talk to the public about, except his work and the technical side of it at that. The engineering profession today is suffering so far as recognition is concerned, because the engineer is too engrossed in his particular specialty—something the world will know nothing about until the problem is solved and the world comes into contact with the result. But I would not have you think that recognition in itself and for itself is the important thing. What the engineer needs is to be made sensible of his obligations to render another kind of service to the public; and this would come through recognition. How to bring it about is the question. I do not see anything better than to broaden the engineer's training. Today very few seek an education for education's sake. What they want is to know how to make more dollars or to make them more easily. Our education today teaches us how to earn more dollars but not how to spend them. So I say we should wake up. We are throttling ourselves and do not realize it. Engineers have led in the world's work and contributed vastly to civilization. In fact our civilization could not exist but for the work of engineers.

Let me say one more word, then I will sit down. The Bible, written two thousand years ago, more or less, is conceded by everybody to be the most wonderful book ever written. It is safe to say that it could not today be duplicated, from the standpoint of wisdom and knowledge of humanity. It may be said to summarize human relations as they existed at the time, or had been handed down by tradition. While rich in such matters there is almost nothing pertaining to civilization in its material aspects—those for which engineering is responsible. Our knowledge of civilization now goes back at least to 6,000 B.C., and we are told that since then there have been no less than six distinct civilizations; that, like man himself, they have all been born, come to maturity and died, a new one

springing from the ashes of the old. Curiously enough one can find in our present civilization almost precisely the same phases as in all previous civilizations.

If one considers that all the wisdom of the world back as far as we have knowledge of it, has been brought to bear on the civilizations of the past what is there to warrant belief that our own will be more enduring? If it is to last longer some untried force must be brought to bear. It may sound absurd, but where will such a force be found outside of engineering, the word being used in its comprehensive sense? Thus far the knowledge and experience of the profession has been used in the creative sense only and never in the preservative sense. Not to take ourselves too seriously, let us consider the engineer as one of the great number of college-trained men, and then ask what has the college-trained man and woman done for the preservation of our civilization? It should be possible, by shaping our training through the preparatory schools and colleges, to bring about during the next two or three hundred years an entirely different outlook on life,—an outlook indeed that might well be counted on to delay the arrival of the dark age that has heretofore fallen with the certainty of death itself on all civilizations. Now, as to our part as engineers. We as a profession embrace a multitude of individual forces acting in many directions—forces that have never been brought together for any one great purpose. We must bring them together so that engineers can exert their power as strongly for the preservation of civilization as they have for the creation of civilization. Preservation is the great constructive word of the future, not only for the engineer but for the men of other professions,—in fact for all the college-trained men and women of the world.

THE WORK OF THE COMING YEAR.

BY CHARLES F. SCOTT, *President.*

The outstanding things before us are:

1. The extension and development of Branches and Sections.

2. The plans proposed by the Development Committee.

3. Increase in membership.

Branches were inaugurated a year ago and have exceeded the expectation of most of us. They have been made a regular feature of the Society's work through the By-Laws adopted by the Society at the Illinois convention.

The work of the Branches indicates how greatly the original purpose of the Society can be extended. The coming together of the teachers for the interchange of ideas and discussion of their various problems has been extended through the medium of Sections and Branches to an attendance ten or fifteen times that at the annual convention. The variety of subjects which have been discussed in local meetings, the interest which has been evoked, the new topics which have arisen as the meetings have progressed—all these indicate that here is a basic field of usefulness.

The particular topic proposed at the beginning of last year was "How to Teach." In a narrow sense this has not been understood by some; in a broader sense, it can include practically every relationship between instructor and student.

I recently had an enlightening discussion with a vigorous young professor with regard to the work of the Society. He was not a member and did not know much about us. In fact, he did not think that a Society of this kind amounted to much. After talking with him for some time, I found that we were not on common ground; that I somehow failed to get his position or he failed to get mine. I then remarked that either we misunderstood one another somehow, or else

he had no conception of what I regarded as an important part of engineering education, namely, the pedagogical part, the art of teaching, the instructing and training as something to be cultivated apart from the technical subject-matter. He replied that he thought the power of the teacher lay in his personality and this was something that could not be acquired. I then suggested that there were many who thought that executives and managers were born and not made and yet engineering schools were turning their attention to the type of training which might develop the capacity of men for such positions—although such courses do not assume to create personality and the native quality essential in the manager. As he himself was interested in industrial management, he at once got the point and asked for a book which would instruct and enlighten.

I am not sure but I have failed to understand others during the past year for a like reason. Have not some of our members interpreted "How to Teach" in a narrow sense and have presumed that the teacher was born and not made and that technical proficiency is really the only thing which the engineering teacher needs?

Branches constitute one of the active means provided for developing the teaching side of the instructor. The branch meeting should be the opportunity for informal and general discussion of all those things that make for better teaching. The topics which were suggested at the beginning of last year and the subjects which have been considered by various Branches during the year indicate a portion of the wide field of subject matter available. The consideration of those subjects and interests which the individual or the school has as its own specific immediate problems are recommended. Such questions will give a directness and a vitality and will awaken the interest and develop thought in a way which outside topics do not.

Where Branches have not been organized, the institutional representative should arrange for a meeting looking towards

starting a Branch early in the year. The new By-Laws provide the means.

Additional Sections should be formed for bringing together the members in a state or in adjoining states.

The Development Committee appointed at the Illinois convention has made its report which is printed in this issue. It should be read by all engineering teachers as it contemplates their participation in the carrying out of its plans.

The Society should have a much larger membership. At the Illinois convention Dr. John of the U. S. Bureau of Education gave figures which were substantially as follows: The number of instructors teaching engineering students is 6,000, about half of these are teaching technical subjects; about 1,500 of this 6,000 are members of the Society. It is the business of this 1,500 to at least double, or preferably, quadruple our membership. Scarcely anything would strengthen our Society and would mean more for engineering teaching than to have all of the 6,000 enrolled in our Society giving their support and interest to the development of engineering education. Those who want cogent reasons why non-engineering teachers should become members may turn to pages 86–94 in October, 1921, ENGINEERING EDUCATION, in which Professors Bird, Franklin, Hughes, Hedrick, Knowles, and Nelson tell what such membership means. Some wonder what they would get out of the Society if they did join. The prime question is not what can a man get out of the Society but what can he put into it—what can he do to build up and strengthen the profession of which he is a part. If he contributes his effort and his interest he may rest assured that he will receive directly and indirectly ample returns for his investment.

The progress of engineering education and of this Society can not rest with the Society's officers or its committees, but are matters in which all must take part. This is the beginning of the year. Let each member make a new start to do his part.

THE THIRTIETH ANNUAL MEETING.

The thirtieth annual meeting of the Society was held at the University of Illinois, Urbana, Ill., on June 20–23, 1922. The sessions were held in the Physics Building. There were 210 in attendance.

The following officers were elected:

Charles F. Scott, Yale University, *President.*
D. S. Kimball, Cornell University, *Vice-President.*
F. G. Higbee, Iowa State University, *Vice-President.*
W. O. Wiley, 432 Fourth Avenue, New York City, *Treasurer.*
F. L. Bishop, University of Pittsburgh, *Secretary.*

Members of Council:

M. W. Alexander, New York City.
Edw. Bennett, University of Wisconsin.
H. S. Evans, University of Colorado.
E. A. Hitchcock, The Ohio State University.
H. J. Hughes, Harvard University.
C. E. Magnusson, University of Washington.
G. C. Shaad, University of Kansas.

The foregoing, together with fourteen elected members whose terms have not expired, and the past presidents constitute the council.

The entertainment furnished by the Local Committee included a reception in the Gymnasium of the Women's Building, a campus movie, open house of the College of Engineering, the annual dinner at the Champaign County Country Club, smoker and round table at the Union Building, a trip to Springfield to visit the home and tomb of Lincoln, a trip to the Chanute Avation Field, Rantoul, and a reception and entertainment for the ladies.

THE THIRTIETH ANNUAL MEETING.

Two very important sessions were held in connection with this meeting, namely, the meeting of the deans of the Mid-West and the meeting of the teachers of English. The first culminated in a Division of the Society composed of deans and administrative officers who are members of the Society. The teachers of English are planning to organize later in the year.

An enjoyable feature of the meeting was the open house of the College of Engineering. This gave to all members and guests an opportunity to visit the laboratories and class rooms of the School and secure first-hand information concerning the work. This is a valuable part of any meeting.

MINUTES OF THE MEETINGS OF THE COUNCIL HELD AT THE UNIVERSITY OF ILLINOIS, JUNE 20, 21, 22, 23.

Members in attendance: Ira O. Baker, Ed. Bennett, F. L. Bishop, H. S. Boardman, F. C. Bolton, G. R. Chatburn, E. F. Coddington, M. E. Cooley, P. H. Daggett, J. H. Dunlap, M. L. Enger, H. S. Evans, J. H. Felgar, J. C. L. Fish, J. F. Hayford, C. S. Howe, E. A. Hitchcock, M. S. Ketchum, O. M. Leland, F. W. McNair, Wm. T. Magruder, W. G. Raymond, W. S. Rodman, C. F. Scott, A. N. Talbot, and C. C. Williams (26).

The following actions were taken:

1. The report of the Treasurer was read and accepted as read. This report was in the form of an audit by a certified accountant.

2. A motion that the Society bear the expense of this audit was unanimously carried.

3. The report of the Secretary read and approved as read.

4. Invitations to hold the 1923 meeting at the University of Utah and Cornell University were read. Upon motion the invitation from Cornell was accepted.

5. The Secretary was instructed to write a letter of appreciation to the University of Utah.

6. Invitations to hold the 1924 meeting were received from the State University of Iowa and the University of Colorado. No action taken.

7. Professor J. D. Hoffman of Purdue University presented the question of student branches of the Society. A motion that this matter be referred to the Purdue Branch of the Society and that they report to the next annual meeting was carried.

8. The question of increasing the dues of instutional members was dropped upon motion.

9. A motion was passed authorizing the officers to use the interest which has accumulated on the life membership fund.

10. The invitation from the American Association for the Advancement of Science to meet with them at their Boston meeting in December was referred to the New England Section for any action they may care to take.

11. A motion was passed recommending to the Society that the annual assessment of $1.00 per member be continued for two years. This income is to be used exclusively for paying the old debts of the Society. The President suggested that the assessment should not be limited to $1.00 for those members who are able and willing to pay more. (This action was later approved by the Society.)

12. The President was instructed to write letters of appreciation to the Past Presidents who had sent letters of regret.

13. Moved that it is the sense of this Council that members of this Society should not answer questionnaires relating to engineering education that do not bear the approval of the Secretary's office.

14. The Secretary's office is to be made a clearing house for questionnaires.

15. The application for the formation of the Ohio Section of the Society was approved.

16. By-Laws were added. (See page 25 of this issue.)

17. It was the sense of the Council that other national engineering societies should not hold their annual meetings at the same time as this Society. The meetings of this Society are held at a time most satisfactory to the institution extending the courtesy, while meetings of the other national engineering societies are not so restricted.

18. A committee by the President and consisting of Dean W. G. Raymond, Dean M. E. Cooley and Dean O. M. Leland reported as follows:

"Your committee on an organization of engineering deans

respectfully submits the following report and recommendations:

There is a real need for an organization made up of the administrative officers of engineering schools, for the consideration of questions which relate particularly to administration. Such a group of executives could be of material and active assistance to this Society in carrying out its policies and recommendations.

Therefore, there should be established in this Society a Division of Deans and Administrative Officers composed of members of the Society who hold such positions. This Division should elect its own officers.

This matter has been discussed with the group of Middle West Deans and they have formally approved the establishment of the above Division within the Society."

19. Motion that the report of the above committee be adopted and recommended to the Society that a Division of Deans and Administrative Officers be formed in the Society. (This action was later approved by the Society.)

20. The following budget for 1922–23 was adopted:

Receipts:

Current dues, Individual	$ 7,000.00
Current dues, Institutional	957.00
Back dues	500.00
Advertising	2,000.00
Sale of publications	250.00
Total receipts	$10,707.00

Disbursements:

A. Illinois meeting (1922)	$ 400.00	
B. Proceedings, Vol. 30	1,500.00	
C. ENGINEERING EDUCATION, Vol. XIII	3,500.00	
D. Committee expenses	150.00	
E. Secretary's honorarium	1,000.00	
H. Clerical assistant	1,680.00	
I. Sundry printing	300.00	
J. Postage and expressage	200.00	
K. Telephone and telegraph	75.00	
L. Office supplies	50.00	8,855.00
Estimated surplus		$ 1,852.00

21. Eighteen individual and one institutional members were approved for election by the Society. (Approved later by Society.)

Aagaard, Arthur H., Assistant Professor of Steam and Gas Engineering, University of Wisconsin, Madison, Wis.

Atkinson, John H., Assistant Professor of English, Iowa State College, Ames, Iowa.

Boring, Maynard M., Assistant Secretary Student Council, General Electric Co., Schenectady, N. Y.

Clark, LeRoy W., Professor of Rational and Technical Mechanics, Rensselaer Polytechnic Institute, Troy, N. Y.

Cofer, David B., Acting Head, Dept. of English, A. & M. College of Texas, College Station, Tex.

Derby, Frank H., Assistant Professor of Civil Engineering, Washington University, St. Louis, Mo.

Dunham, Clarence W., Assistant, Dept. of Rational and Technical Mechanics, Rensselaer Polytechnic Institute, Troy, N. Y.

Estep, Thos. G., Associate Professor of Mechanical Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

Gough, Achilles C., Dean, School of Engineering and Trades, Idaho Technical Institute, Pocatello, Ida.

Greiner, Otta A., Associate Professor of Modern Languages, Purdue University, LaFayette, Ind.

Lange, Paulus J. H., Instructor in English, Iowa State College, Ames, Iowa.

Raymond, William R., Professor of English; Chairman, Engineering Group of English Teachers, Iowa State College, Ames, Iowa.

Sweet, A. T. (Capt.), Instructor in Metallurgy and Ore Dressing, Michigan College of Mines, Houghton, Mich.

Shibata, Keisaku, Professor of Civil Engineering, Tokyo Imperial University, Tokyo, Japan.

Swartzel, Karl D., Professor of Mathematics, University of Pittsburgh, Pittsburgh, Pa.

Teeple, Perry M., Acting Professor of Engineering, University of South Carolina, Columbia, S. C.

Wendt, Robert E., Instructor in Foundry, Purdue University, LaFayette, Ind.

Wharen, George B., Professor of Mechanical Engineering, University of North Dakota, Grand Forks, N. D.

Queen's University, Kingston, Ont., Canada. R. Bruce Taylor, Principal.

22. Professor Baker suggested that a registration fee be charged at each annual meeting to cover the cost of the meeting. No action taken.

President Scott presented the following statements to the Council:

1. That the activities of the Society have increased during the past year and can be greatly extended through the organization of Branches.

2. That the joint meeting held with the representatives of the National Industrial Conference Board gives promise of much gain to engineering education and to industry.

3. That engineering schools are not now meeting their opportunities and responsibilities in training men for the future service which engineering graduates should render.

4. That there is reasonable expectation that funds may be secured for aiding in carrying out a constructive program if proposed by the Society.

MOTION: That the Council appoint a committee to consider this and report to the Council at a later meeting. The Committee appointed consisted of F. W. McNair, M. E. Cooley and G. R. Chatburn.

This Committee reported as follows:

WHEREAS, the President of this Society visioning its future has, after a careful study of the possibilities of greatly enlarging the scope of its activities made certain recommendations, and

WHEREAS, in his opinion there is a reasonable possibility of securing funds for the Society for the Promotion of En-

gineering Education if an adequate plan is developed and endorsed by the Society, and

WHEREAS, in the opinion of the Council this Society stands challenged by the condition thus presented, now be it

Resolved, That the President of the Society appoint a committee of five (5) members, including himself, to study the development of the Society for the Promotion of Engineering Education and to formulate an answer to the question "What can the Society do in a comprehensive way to develop, broaden and enrich engineering education?", and further

That this Committee shall report, as early as feasible, formulations of answer back to the Council for action on the Committee's recommendations.

Respectfully submitted,

F. L. BISHOP,
Secretary.

BY-LAWS ADOPTED AT ILLINOIS MEETING.

Sections and Branches.

Tenth: A Section of the Society may be formed by members in two or more institutions or by the members within a prescribed territory. A Section may be formed in any locality by a temporary organization which shall become a duly authorized section of the Society upon the approval of the Council. Sections may determine their own form of organization but shall operate in conformity with the Constitution and By-Laws of the Society and shall make a report of their proceedings to the Secretary of the Society. Sections shall be self-sustaining.

Papers and discussions presented before Sections shall be the property of the Society and may be published as Society proceedings only on authority of the Publication committee.

Eleventh: A Branch may be formed by the members of a single institution. A Branch may be formed in any institution by a temporary organization which shall become a duly authorized Branch of the Society upon approval by the Executive Committee. Branches may determine their own form of organization but shall operate in conformity with the Constitution and By-Laws of the Society and shall make a report of their proceedings to the Secretary of the Society. Branches shall be self-sustaining.

Papers and discussions presented before the Branches shall be the property of the Society and may be published as Society proceedings only on authority of the Publication Committee.

Branches may coöperate with or be a part of other organizations having the same general purpose as this Society. The general purpose of Branches is to extend the interest in, and the discussion of, questions relating to the teaching of

engineering students, and to bring to the Society at large, through its publications, the activities in all institutions that will be serviceable to the members of the Society.

Twelfth: Divisons may be formed by any group of members for the consideration of questions which relate particularly to that group.

REPORT OF DEVELOPMENT COMMITTEE.

Letter of Transmittal.

Pittsburgh, Pa., August 8, 1922.

To the Members of the Council.

Gentlemen:

At the Urbana convention you provided that the President should appoint a committee of five, including himself, to study the development of the Society.

I appointed President F. W. McNair, Dean M. E. Cooley, Professor D. C. Jackson, and Professor J. H. Dunlap, recently elected Secretary of the A. S. C. E. As provided by you, the Secretary of the Society, Dean Bishop, has acted with the Committee.

The Committee met in New York on July 10, 11 and 12 and then practically completed its report in Pittsburgh on July 19. It was afterward edited and revised in form. Professors Jackson and Dunlap were unable to attend these meetings.

The Committee has proposed for your consideration a program and a plan of action. It has not been unmindful of various matters to which reference has not been made in the report such as Sections and Branches, enlarging and enriching the Bulletin, and the employment service, but these are regarded as secondary and furthermore they would presumably follow the activities proposed.

Our real function as a Society is to develop teachers who can train engineers. Real progress must come largely from inward growth. The greatest gain must come from better teachers and stronger faculties. The present plan is not something apart from the schools; it is not a scheme by which

some super-committee shall evolve a solution to engineering education in a formal report. The movement contemplates active participation by the schools and the proposed organized effort should have its richest results in directing attention, awakening interest and securing participation of engineering teachers and faculties in this work.

A statement of why you are endorsing, if you do, this project will be serviceable in securing funds and in maturing and working out a detailed plan. Talk it over with others. Create and crystallize sentiment.

In response to requests letters of suggestion have been received from a number of members. These have been constructive and of material assistance. Practically all have suggested a general plan of investigation or research such as is proposed in the report.

It was with reluctance that I assented to the provision that I should appoint the proposed Board but the Committee deemed this the most feasible plan. In order that you may better understand what would probably follow your adoption of the resolution, I may add that several members of the initial board would probably be drawn from the membership of the Committee. I have discussed with several the matter of the director and find a strong sentiment that Dean M. E. Cooley would be an admirable man for the place, although he may not be available.

Your prompt reply will facilitate action.

Very truly yours,

CHARLES F. SCOTT,
President.

Will you please indicate on the enclosed postcard your official vote on the attached report? Please send by letter suggestions.

F. L. BISHOP,
Secretary.

REPORT OF DEVELOPMENT COMMITTEE.

THE REPORT OF THE COMMITTEE.

PITTSBURGH, PA., August 8, 1922.

TO THE MEMBERS OF THE COUNCIL.

Gentlemen:

Your committee appointed to study the development of the Society for the Promotion of Engineering Education and to formulate an answer to the question "What can the Society do in a comprehensive way to develop, broaden and enrich engineering education" begs leave to submit its report:

It may be well first to call attention to such general aspects of the question as have influenced your committee in reaching its conclusions. The probable future of engineering perhaps has had most influence. It will be accepted as a fact that the engineer of tomorrow will be called upon to take even a more important part than the engineer of today in great enterprises, both private and public. He will be called upon for general service in organization and leadership as well as for technical service in the solution of new problems (industrial, economic, governmental and social) which the engineering applications of science have produced. This means imagination, vision, the power to conceive and the ability to carry out great projects.

The problem of engineering education is to determine and to meet the progressive demands of a rapidly changing civilization. What constitutes these demands is a question being considered by educators, by engineering societies, by organizations of industries and public utilities and by others. Unfortunately, there has been almost no coördination of effort, and there is lack of agreement on even fundamental objectives. The first necessity then would seem to be an investigation to determine just what the facts are.

While knowledge of the facts is of course necessary before any constructive steps can be taken your committee believes that it is fully as important to develop high ideals of

engineering education in both students and teachers. It is thought that through the immediate stimulation of individual teachers and individual institutions advancement may come in larger measure on the adoption of the recommendations with which this report concludes. The organization to carry out these recommendations should be directed by a man who has the confidence of the schools, of the profession, of the industries and of the public. He should be an inspiring speaker as one of his duties would be to visit engineering schools and meet both teachers and students. There should be associated with him other men who could assist in this work. With this general view of the conditions your committee lays before you its findings.

The question involves two fundamental inquiries:

A. What the engineer graduate should be.

B. What the training of the engineer student should be and the influence surrounding him.

In ascertaining *A* it will be necessary to study the functions of the engineer of the past and of the present time; and to try to conceive those of the future, keeping in mind the highest ideals of service to be rendered the public and the profession.

In determining *B* it will be necessary to define and express as clearly as may be those high and comprehensive ideals of service, that they may be readily comprehended by employers of engineer graduates, and by faculties and students.

Having determined *A* and *B* then comes the sublime duty of this Society to see to it that teachers, students, employers and the profession itself are all roused to the Society's enthusiastic support in making the investigations, in formulating the conclusions to be drawn from them, and in executing the plans evolved for the future of engineering education.

Recognizing the principle that to handle forces they must first be known in magnitude and direction after which they can be resolved and combined, your committee feels that the fundamental requirement is to investigate comprehensively

the facts bearing on engineering education in its several fields and to arrange and present the results.

These fields are, first of all, civilization itself, after which may come the needs of the profession of engineering and the needs of industry,—the three together determining the type of engineer graduate required. Then may be considered the material to be wrought upon, namely, the student; and finally, the machinery of education, including curriculum, teaching staff, facilities and other factors of college life. With the results of these investigations clearly presented, it ought to be possible to determine the procedure which in the time available (4, 5 or 6 years) will best prepare the engineer graduate for his career.

As one result of these investigations there may follow the answer to another question, namely, whether the wide range of service which men of engineering training are called upon to perform makes desirable different types of engineering schools such as one producing broadly educated men and another producing highly trained specialists.

The foregoing illustrates the steps which to your committee seem essential. In order that they may be taken it is deemed necessary to establish an organization which may be called a Board of Investigation and Coördination. The instrumentalities of this Board would be a staff of investigators in charge of a director; and a body of counsellors embracing representatives from the several fields concerned in the investigation. There should, for example, be representatives from the U. S. Bureau of Education, the professions, the industries, the National Education Association and the public.

Your committee would therefore recommend:

I. That there be created within the Society a Board of Investigation and Coördination, consisting of five (5) members, under whose general direction there shall be organized and conducted (*a*) an active campaign for the promotion of engineering education in light of the needs of the future as those needs may be developed; (*b*) there shall be coördinated

as far as possible the activities of the various agencies interested in promoting engineering education; and (*c*) there shall be conducted research in engineering education.

II. That there be authorized a Board of Counsellors consisting of representatives from the several fields to which engineering education is related, to advise and assist the Board of Investigation and Coördination.

III. That there be authorized a director, with an adequate staff, the director to be appointed by the Board of Investigation and Coördination, and when appointed to be ex-officio Chairman of the Board, the Secretary of the Society to be ex-officio Secretary of the Board.

IV. That progress reports to the Society be published periodically in ENGINEERING EDUCATION, the bulletin of the Society.

V. That President Charles F. Scott be a member of the Board and have authority to appoint the other members; that the terms of the initial members be 5, 4, 3, 2 and 1 years respectively, the individual assignments being made by lot. That vacancies be filled by the Council on nominations made by the Board and that vacancies be created by the Council upon recommendation of the Board.

VI. That the objects (among others) for which the Board is created shall be considered to be:

1. To ascertain the facts in engineering education, such as concerns (*a*) teachers, their origin, training, experience and effectiveness; (*b*) teaching facilities; (*c*) curriculums; (*d*) students and graduates, their origin, training, experience and effectiveness.
2. To ascertain present and future requirements in the fields served by engineer graduates.
3. To present the facts and requirements for their bearing on the training of the engineer to the end that he may (*a*) develop himself and his profession; (*b*) realize and fulfill his obligation to society.

4. To maintain close contact with engineering schools enabling them to participate in the investigations; and reporting to them from time to time; to the end that the developments may be continuous from the initial contact between the colleges and the agencies of the Board.

5. To secure the necessary funds for these purposes.

(Signed) M. E. COOLEY,
J. H. DUNLAP,
D. C. JACKSON,
F. W. MCNAIR,
C. F. SCOTT, *Chairman.*

THE S. P. E. E. AND THE INDUSTRIES.

A Telegram to the Society.

NEW YORK N Y. June 19 1922.

PROFESSOR CHARLES F. SCOTT
S P E E CONVENTION UNIVERSITY OF ILL URBANA ILL PLEASE CONVEY TO S P E E CONVENTION BEST WISH FOR SUCCESS AND ASSURANCE OF HEARTY CO-OPERATION STOP NATIONAL INDUSTRIAL CONFERENCE BOARD AS THE RESEARCH ORGANIZATION OF AMERICAN INDUSTRY IN THE FIELD OF INDUSTRIAL ECONOMICS INTERESTED IN FINDING FACTS UNDERLYING OUR NATIONAL ECONOMIC PROBLEMS AND PROPERLY EVALUATING THESE FACTS AS SAFEST BASIS FOR SOLUTION OF OUR PROBLEMS RECOGNIZES VAST IMPORTANCE OF ENGINEERING MIND IN THIS WORK AND OPPORTUNITY OF ENGINEERS TO CONTRIBUTE TO SOLUTION OF ECONOMIC AND SOCIAL PROBLEMS CONFRONTING INDUSTRY STOP WE ARE KEENLY INTERESTED IN ENGINEERING EDUCATION AS AN ESSENTIAL PART OF THE INDUSTRIAL SYSTEM WE WELCOME HEARTILY COOPERATION OF ENGINEERING PROFESSORS IN WORKING OUT FUNDAMENTALS ON WHICH RELATIONSHIP OF ENGINEERING EDUCATION AND INDUSTRY MUST REST SO THAT ENGINEERS MAY BE TRAINED EFFICIENTLY TO RENDER EFFECTIVE CONSTRUCTIVE SERVICE TO INDUSTRY AND SOCIETY STOP SHALL PERSONALLY GLADLY CALL ATTENTION OF INDIVIDUAL INDUSTRIALISTS TO NEED FOR MORAL AND FINANCIAL SUPPORT FOR YOUR SOCIETY.

M. W. ALEXANDER

THE S. P. E. E. AND THE INDUSTRIES.

A Letter to Members of the Society.

August 12, 1922.

Dear Sir:

As the outgrowth of a conversation between the President of the Society and Mr. Alexander, Managing Director of the National Industrial Conference Board, there resulted a Joint Conference Committee on Engineering Education comprising representatives of industry and of our Society. The membership and various facts regarding the committee are set forth in the accompanying letter which Mr. Alexander has issued to a number of men prominent in industry.

At a meeting held on June 2, the representatives of industry laid great emphasis on the importance of men of engineering training in industry, not only for technical positions but for leadership. They said that industry in general is not appreciative of this need nor are its attitude toward and treatment of engineering graduates what they should be. They made various constructive suggestions regarding the improvement of the schools and were anxious to determine in what ways the industries could be helpful to the engineering schools. The professors present were much impressed by the attitude of men high in industry toward education and are hopeful and confident that important results may be secured through the joint committee.

Mr. Alexander's letter indicates the vital importance which industry attaches to the engineering school as he states that they are "after all a part of the industrial system." Many replies have been received. They came from men such as railroad presidents, etc. They indicate a serious interest and readiness to act.

For the use of the Joint Conference Committee, will you be good enough to express your views, from the standpoint of the engineering schools, as to the ways in which the industries may be of service to engineering education and how on the other hand the engineering schools may better serve the industries?

An early reply would be appreciated. Letters should be in my hands early in October in order that they may be available for the next meeting of the committee.

Yours very truly,

CHARLES F. SCOTT,
President.

FREDERICK P. FISH, CHAIRMAN
LOYALL A. OSBORNE, VICE-CHAIRMAN
JAMES H. PERKINS, TREASURER
MAGNUS W. ALEXANDER, MANAGING DIRECTOR

NATIONAL INDUSTRIAL CONFERENCE BOARD
10 EAST 39TH STREET, NEW YORK

BRANCH OFFICE
SOUTHERN BUILDING
WASHINGTON, D. C.

AFFILIATED ORGANIZATIONS

AMERICAN COTTON MANUFACTURERS' ASSOCIATION
AMERICAN ELECTRIC RAILWAY ASSOCIATION
AMERICAN HARDWARE MANUFACTURERS' ASSOCIATION
AMERICAN MALLEABLE CASTINGS ASSOCIATION
AMERICAN PAPER AND PULP ASSOCIATION
ELECTRICAL MANUFACTURERS' CLUB
INSTITUTE OF MAKERS OF EXPLOSIVES
MANUFACTURING CHEMISTS' ASSOCIATION OF THE UNITED STATES
NATIONAL ASSOCIATION OF COTTON MANUFACTURERS
NATIONAL ASSOCIATION OF FINISHERS OF COTTON FABRICS
NATIONAL ASSOCIATION OF MANUFACTURERS
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THE AMERICAN PIG IRON ASSOCIATION
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ASSOCIATED INDUSTRIES OF NEW YORK STATE, INC.
ILLINOIS MANUFACTURERS' ASSOCIATION
THE MANUFACTURERS' ASSOCIATION OF CONNECTICUT, INC.

My dear Mr.

In accordance with a resolution of the National Industrial Conference Board adopted at its meeting in January, 1922, a Joint Conference Committee on Engineering Education was appointed by the Board, in conjunction with the Society for the Promotion of Engineering Education, for the consideration of present engineering education in colleges and universities and for suggested improvements relating thereto. The Joint Conference Committee so appointed is composed of the following:

Representing Industry.

S. P. Bush, President, Buckeye Steel Castings Co., Columbus, Ohio.
H. E. Coffin, Vice-President, Hudson Motor Car Co., Detroit, Mich.
Col. T. C. Dickson, U. S. A., Commanding Officer, U. S. Arsenal, Watertown, Mass.
Howard Elliott, Chairman, Northern Pacific Railroad, New York City.
E. M. Herr, President, Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.
Wm. H. Nichols, Chairman, Allied Chemical and Dye Corp., New York City.
A. H. Rogers, President, Mining and Metallurgical Society of America, N. Y. C.
Henry D. Sharpe, Treasurer, Brown & Sharpe Mfg. Co., Providence, R. I.

Representing Engineering Education.

R. H. Fernald, Prof. of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pa.

H. J. Hughes, Dean, Harvard Engineering School, Cambridge, Mass.

D. C. Jackson, Prof. of Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

F. W. McNair, President, Michigan College of Mines, Houghton, Mich.

Ira Remsen, Prof. of Chemistry, Johns Hopkins University, Baltimore, Md.

J. W. Roe, Prof. of Administrative Engineering, New York University, N. Y. C.

H. Schneider, Dean, College of Engineering and Commerce, University of Cincinnati, Cincinnati, Ohio.

C. F. Scott, President, Society for the Promotion of Engineering Education, Yale University, New Haven, Conn.

Frederick P. Fish, Esq., the Chairman of the National Industrial Conference Board, was selected as Chairman of the Joint Conference Committee and Mr. A. Trowbridge, formerly professor of mechanical engineering and later engaged in the management of manufacturing enterprises has been appointed the permanent Secretary to the Committee.

The first meeting of the Committee was held on June 2d, lasting throughout the day. Many meritorious suggestions were presented by various members of the Committee, and all agreed on the importance of the work to be accomplished by the Conference in the interest of American industry.

It was emphasized as a primary consideration that American industry's efficient development and contribution to the national welfare is closely bound up with the character and efficiency of the professional engineers educated in the various engineering schools, and required in industry as technical experts and inventors, as managers and executives of industrial enterprises. Equally important is the development of competent men as instructors in the engineering schools.

For these reasons, and also because engineering schools are, after all, a part of the industrial system, and must therefore function efficiently if the system as a whole is to be efficient, it

was agreed that there must be a close and coöperative relationship between engineering schools and American industry in its various branches; and adequate methods must be developed under which each will help the other in the common cause of adequately training professional engineers.

We should greatly appreciate an expression of your own views in respect to this important matter in order that the Committee may be benefited by whatever suggestions you might make for the improvement of engineering education and in respect to methods of adequate coöperation between American industry and engineering schools. The Committee is not concerned with details of college curricula, but with the broader aspects of the problem, such as the best way of fitting the graduate of the engineering schools into industry; whether and how best to give the student industrial training coincident with his academic studies; an adequate supply of high-grade instructors and a better understanding of their responsibilities by both industry and the engineering schools. Your views, based as they are on knowledge and experience, will greatly facilitate the work of the Committee, and give it a practical and constructive character.

Soliciting the favor of an early reply,

Very truly yours,

M. W. ALEXANDER,
Managing Director.

USE OF EBBINGHAUS TEST IN WRITTEN LESSONS.

BY STUART SIMS,

Head, Civil Engineering Department, Oregon State Agricultural College.

This well-known psychological intelligence test consists of written prose matter from which have been omitted the key words. The student is asked to fill in these words in the shortest time possible, a maximum time limit being set for all individuals tested.

In order to conserve time, to improve the students' attitude, to secure definite reactions, and to provide means for measuring more exactly the students' learning, mutilated texts similar to that briefly described are being used in the courses in surveying, descriptive geometry, sanitary engineering, water supply, and others in the civil engineering department of the Oregon State Agricultural College.

The instructors in the several courses concerned believe that excellent all around results are being secured with them and favorable comments by instructors in other Schools upon this campus have been made on the method. Since all students being tested are timed with a stop watch their sporting instincts are aroused so that they are all alert in every way; the instructor is able to obtain a definite reaction to every important point in the assigned lesson and can, whenever he elects, arrange to have as many recalls of fundamental points as he deems necessary to effect thorough learning; after the tests are completed a minimum amount of time is required to check the papers and to secure a very definite measure of the students' learning.

These tests usually require about ten minutes at the beginning of the hour so that the instructor has the remaining forty minutes to carefully explain the advance assignment as well as any point not clearly understood in the lesson for the day.

USE OF EBBINGHAUS TEST IN WRITTEN LESSONS.

While the department believes the recitation method of teaching a poor one and prefers that of supervised study, for many reasons it is not possible to secure the latter in all of its courses. Where the recitation method is in use the mutilated text device is very helpful especially in those courses where certain students are able, under other conditions to present a glittering array of words in lieu of facts. A few sample sheets follow.

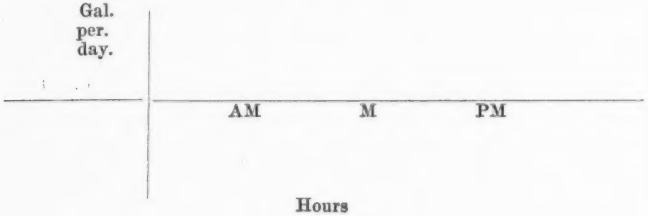
O. A. C.

Course ..... Grade .....
Sewer Design Department of Civil Engineering Deduct 4 each
Date ..... mistake.

Quiz No. 2–A.

Name .....

1. The amount of sanitary sewage flow per capita varies ..... with the water consumption. It is about ..... % of the water consumption.
2. The water consumption in American cities varies from ..... gallons to ..... gallons per capita per day.
3. The factor most directly influencing this large difference is .....
4. Water consumption may be analyzed under four heads.
   1. .....
   2. .....
   3. .....
   4. .....
5. The consumption rate varies ..... with the population of cities in which statistics have been obtained.
6. An effective means of reducing the waste is to ..... the supply.
7. The following curve represents roughly the shape of the daily water consumption.



8. The maximum rate of water consumption is about ..... times the minimum.

9. A common assumption for the maximum sewage flow is that ..... the daily flow will run off in about ..... hours.

10. Ground water infiltration depends upon (1) ..... (2) ....., and (3) .....

11. The most effective manners of expressing infiltration are in (1) gallons per day per ..... for brick or block sewers and (2) gal. per day per ..... for tile sewers.

O. A. C.

Department of Civil Engineering

Course CE 124 Grade .....

Date ..... P. and K., p. 13–17 Deduct 4 each mistake.

Quiz No. 2.

Name .....

I. English Methods of Measurement.
   1. By ..... chain.
      a. Length .....
      b. Divided into ..... and .....
   2. By ..... chain.
      a. Length .....
      b. Divided into .....

II. Linear Measuring Instruments are made in two forms:
   1. .....
   2. .....

III. Chaining.
   1. The party is composed of
      a. .....
      b. .....
   2. Apparatus used:
      a. .....
      b. .....
      c. .....
      d. .....

IV. Methods.
   1. The O. K. signals are
      a. For rear chainman .....
         meaning .....
         .....
      b. For head chairman .....
         meaning .....
         .....

2. The length of tally is .....
3. For accurate measurements between two points the chain must be kept
   a. .....
   b. .....
   c. .....

O. A. C.

Department of Civil Engineering.

Course IE 422
Public Health and Sanitation
Quiz No. 1.

Date 1921

Grade .....
(3 off for each mistake)

Name .....

RAINFALL AND RUN-OF

Sewer Design, Ogden. Chap. 3, 4. 5, and 6.

I. Precipitation data is of value to the engineer in determining the ..... sewers because it is an index to the ..... quantity of run-off for a comparatively ..... interval.

II. Damaging storms may be divided into two classes:
   1. Rains of ..... intensity and ..... duration.
   2. Rains of ..... intensity and ..... duration.

III. The gages used in determining rainfall are preferably of the ..... type. Maximum rates of rainfall have been observed as high as ..... inches in sixty minutes' time. Intensity curves are usually plotted with 'y' axis as ..... in ..... for ....., and 'x' axis as ..... of storm in ..... The general type of curve is that of a ....

IV. The run-off varies with the character of the ..... and character of the ..... Impervious areas such as ..... and ..... vary with the ..... of the population and therefore the run-off varies with the ..... of the population.

V. Mathematical formulæ are of the ..... type, that is, they have been partially or wholly derived by ..... data.

Five factors usually considered are:

1. Q = ...
2. c = ...
3. r = ...
4. s = ...
5. A = ...